CEIT – 04 – 502A
EE04L / MWF / 4:30p – 6:00p
LABORATORY REPORT 6

GROUP 6
Group Members:
Bernardo, Raevon Thaddeus C.
Bertumen, Charles Jefferson
Cabanes, Christine Joy P.
Cesar, John Lester M.
Landicho, Bhaves Nicolette D.
Solis, Johnloyd P.

Machine Problem 6: Lagrange Polynomial and Newton's Divided Difference Interpolation

Program Name: Group 6 Interpolation Tech

Acronym: G6–IT

Current Version: 1.0.1

Version History:

- **1.0.1**
- Designed in Scilab version 6.0.2
- Features two program modes: **Lagrange Polynomial Interpolation** and **Newton's Divided Difference**
- **Lagrange Polynomial Interpolation** mode features two program types: **Linear Interpolation** and **Quadratic Interpolation**
- Features much improved User Interface (UI) as compared to its predessors

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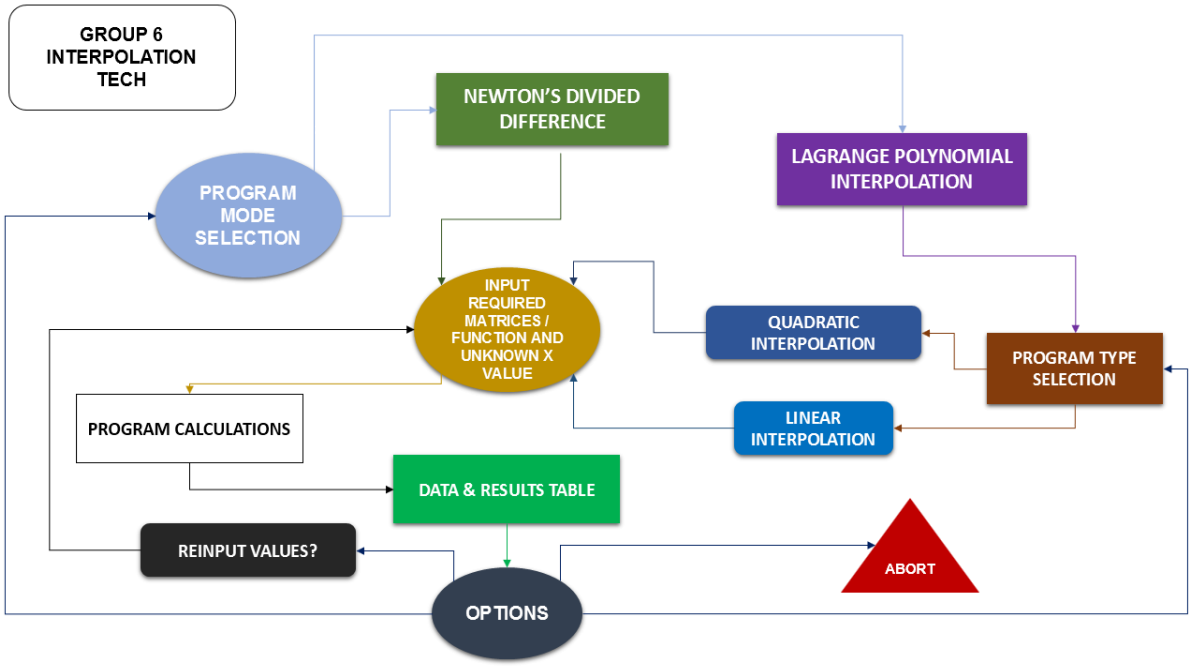
I. Flow Chart



The program starts with the main page which is the program mode selection page. In this page, the user will be able to choose between which program mode, be it either **Lagrange Polynomial Interpolation** or **Newton's Divided Difference,** to go with accordingly. Upon selecting Lagrange Polynomial Interpolation mode, the program will prompt the user to choose between (**a**) **Linear Inerpolation** and (**b**) **Quadratic Interpolation**. Selecting either of the two will lead to the user inputting an $\mathbf{X_i}$ matrix that is needed for program calculations. Then the user will be able to choose if he will be inputting a known function or choose to determine the unknown **X** value by inputting a set of $\mathbf{f(X_i)}$ values via matrix. Similarly, Newton's Divided Difference mode will require the user to input matrices or known polynomial function in order for the program to compute for the unknown **X** value. Both modes will also present **Data & Results Table** in orer to show the user the values that were computed during the process of determining the unknown value of **f(x)**. After each ending results, the user will be given an options menu, inquiring about the user's further action in which they can choose to either (**a**) **Reinput values**, (**b**) **Go back to program mode selection**, (**c**) **Choose another program type** or (**d**) **Exit the program**, showcasing the program's convenient user interface flow.

II. Program Instructions

How to Use G6-CFP 1.0.1:

Program Mode Selection

In this page, you can choose between which type of program do you want to proceed with. The choices of the user are (a) **Lagrange Polynomial Interpolation** (b) **Newton's Divided Difference**.

Lagrange Polynomial Interpolation Mode: Program Type Selection

In this page, you can choose between which nonlinear type are you going to proceed with. The choices of the user are (a **Linear Inerpolation** and (b) **Quadratic Interpolation**.

Lagrange Polynomial Interpolation Mode: Linear Interpolation

In this page, you will be prompted by the program to input an $\mathbf{X_i}$ matrix that corresponds to your desired data set. Then you will be given a choise to input your own polynomial function or if you require an f(x) value of an unknown function, then you will have to input a $\mathbf{f(X_i)}$ matrix. You will also be prompted to input the unknown value of X that you are looking for.

Lagrange Polynomial Interpolation Mode: Quadratic Interpolation

In this page, you will be prompted by the program to input an $\mathbf{X_i}$ matrix that corresponds to your desired data set. Then you will be given a choise to input your own polynomial function or if you require an f(x) value of an unknown function, then you will have to input a $\mathbf{f(X_i)}$ matrix. You will also be prompted to input the unknown value of X that you are looking for.

Newton's Divded Difference Mode

In this page, you will be prompted by the program to input an $\mathbf{X_i}$ matrix that corresponds to your desired data set. Then you will be given a choise to input your own polynomial function or if you require an f(x) value of an unknown function, then you will have to input a $\mathbf{f(X_i)}$ matrix. You will also be prompted to input the unknown value of X that you are looking for.

How to input your own matrices:

e.g. (2, 3), (3, 5), (4, 7), (5 ,10) = desired data set

then....

Please input your X matrix: [2 3 4 5]

Please input your Y matrix: [3 5 7 10]

Note: It is highly recommended for the user to follow the instructions in running the program.

III. Sample Output

PROGRAM MODE SELECTION PAGE

```
Welcome to Group 6 Interpolation Tech 1.0.1!

Program Mode Selection:

a.) Lagrange Polynomial Interpolation
b.) Newton Divided Difference

Choose desired program mode:
```

LAGRANGE POLYNOMIAL INTERPOLATION: PROGRAM TYPE SELECTION PAGE

```
Program Mode: Lagrange Polynomial Interpolation

Type of Lagrange Polynomial Interpolation:

a.) Linear Interpolation
b.) Quadratic Interpolation

Choose desired program type:
```

ABORT PAGE

```
Thank you for using our program!

For any inquiries, contact Head Developer through this enail:

bernardoraevon@gmail.com
-->
```

LAGRANGE INTERPOLATION: LINEAR INTERPOLATION (OPTION “A”)

```
Program Mode: Lagrange Polynomial Interpolation

Program Type: Linear Interpolation


Please input the following:



Note: Xi matrix should be: [x0 x1]

Xi matrix:  [9.97 10.15]



Options:

a.) Input your own polynomial function (Program will solve for f(xi) values)

b.) Input your own f(xi) values (Matrix format)


Choose desired action:  a


The unkown X value:  10.11

Polynomial function:  log(x)
```

```
Data Table

i       xi              f(xi)
0       9.9700          2.2996
1       10.1500         2.3175



Results Table

L0              L1              f(x)            P1(x)           Error
0.2222          0.7778          2.3135          2.3135          0.0000
```

LAGRANGE INTERPOLATION: LINEAR INTERPOLATION (OPTION “B”)

```
Program Mode: Lagrange Polynomial Interpolation

Program Type: Linear Interpolation


Please input the following:



Note: Xi matrix should be: [x0 x1]

Xi matrix:  [9.97 10.15]



Options:

a.) Input your own polynomial function (Program will solve for f(xi) values)

b.) Input your own f(xi) values (Matrix format)


Choose desired action:  b


Note: f(xi) matrix should be: [f(x0) f(x1)]

f(Xi) matrix:  [2.29958 2.31747]


The unkown X value:  10.11
```

```
Data Table

i       xi              f(xi)
0       9.9700          2.2996
1       10.1500         2.3175



Results Table

L0              L1              P1(x)
0.2222          0.7778          2.3135
```

LAGRANGE INTERPOLATION: QUADRATIC INTERPOLATION (OPTION “A”)

```
Program Mode: Lagrange Polynomial Interpolation

Program Type: Quadratic Interpolation


Please input the following:



Note: Xi matrix should be: [x0 x1 x3]

Xi matrix:  [9.97 10.15 10.19]



Options:

a.) Input your own polynomial function (Program will solve for f(xi) values)

b.) Input your own f(xi) values (Matrix format)


Choose desired action:  a


The unkown X value:  10.11

Polynomial function:  log(x)
```

```
Data Table

i       xi              f(xi)
0       9.9700          2.2996
1       10.1500         2.3175
2       10.1900         2.3214



Results Table

L0              L1              L2              f(x)            P2(x)           Error
0.0808          1.5556          -0.6364         2.3135          2.3136          0.0001
```

LAGRANGE INTERPOLATION: QUADRATIC INTERPOLATION (OPTION “B”)

```
Program Mode: Lagrange Polynomial Interpolation

Program Type: Quadratic Interpolation


Please input the following:



Note: Xi matrix should be: [x0 x1 x3]

Xi matrix:  [9.97 10.15 10.19]



Options:

a.) Input your own polynomial function (Program will solve for f(xi) values)

b.) Input your own f(xi) values (Matrix format)


Choose desired action:  b


Note: f(xi) matrix should be: [f(x0) f(x1) f(x2)]

f(Xi) matrix:  [2.29958 2.31747 2.32141]


The unkown X value:  10.11
```

```
Data Table

i       xi              f(xi)
0       9.9700          2.2996
1       10.1500         2.3175
2       10.1900         2.3214



Results Table

L0              L1              L2              P2(x)
0.0808          1.5556          -0.6364         2.3136
```

NEWTON'S DIVIDED DIFFERENCE (OPTION "A")

```
Program Mode: Newton Divided Difference



Please input the following:

Note: Xi matrix should be: [x0 x1 x2 --> xn]


Xi matrix:  [6 7 7.5 7.7]



Options:

a.) Input your own polynomial function (Program will solve for f(xi) values)

b.) Input your own f(xi) values (Matrix format)


Choose desired action:  a


The unkown X value:  6.5


Polynomial function:  log(x)
```

```
Data Table

i       xi              f(xi)
0       6.0000          0.0008
1       7.0000          -0.0093
2       7.5000          0.1315
3       7.7000          2.0412

Results Table

x               f(x)            f(x)calculated          Error
6.5000          1.8718          1.8717                  0.0001
```

NEWTON'S DIVIDED DIFFERENCE (OPTION "B")

```
Program Mode: Newton Divided Difference



Please input the following:

Note: Xi matrix should be: [x0 x1 x2 --> xn]


Xi matrix:  [6 7 7.5 7.7]



Options:

a.) Input your own polynomial function (Program will solve for f(xi) values)

b.) Input your own f(xi) values (Matrix format)


Choose desired action:  b


f(Xi) matrix:  [0.1506 0.3001 0.2663 0.2346]


The unkown X value:  6.5
```

```
Data Table

i       xi              f(xi)
0       6.0000          0.0087
1       7.0000          -0.1299
2       7.5000          -0.1585
3       7.7000          0.2346

Results Table

x               f(x)calculated
6.5000          0.2638
```

OPTIONS MENU: LINEAR AND QUADRATIC INTERPOLATION

```
Options:

a.) Reinput values

b.) Go back to program mode selection

c.) Choose another type of polynomial interpolation

d.) Exit program
```

OPTIONS MENU: NEWTON'S DIVIDED DIFFERENCE

```
Thank you for using our program!

For any inquiries, contact Head Developer through this enail:

bernardoraevon@gmail.com

-->
```

Due to being designed in Scilab 6.0.2, the console screen appears much more cleaner when using Scilab 6.0.2 rather than the current updated version of Scilab. In Scilab 6.1.1, quotation marks are displayed which make it look messier whereas compared to Scilab 6.0.2, quotation marks are not displayed on the console screen.

– **Head Developer's Remark**

IV. Development Team Contributions

Development Team Members:

- ❖ Bernardo, Raevon Thaddeus C.
- Head Developer & Programmer
- Designed the algorithms of the working program
- Final debugger of the program

- ❖ Bertumen, Charles Jefferson
- Assistant Developer & Programmer
- Assisted in conceptualizing the algorithms of the program
- Assisted in assessing the performance of the trial version
- Assisted in debugging the program

- ❖ Cabanes, Christine Joy P.
- Assistant Developer & Programmer
- Assisted in conceptualizing the algorithms of the program
- Assisted in assessing the performance of the trial version
- Assisted in debugging the program

- ❖ Cesar, John Lester M.
- Assistant Developer & Programmer
- Assisted in conceptualizing the algorithms of the program
- Assisted in assessing the performance of the trial version
- Assisted in debugging the program

- ❖ Landicho, Bhaves Nicolette D.
- Assistant Developer & Programmer
- Assisted in conceptualizing the algorithms of the program
- Assisted in assessing the performance of the trial version
- Assisted in debugging the program

- ❖ Solis, Johnloyd P.
- Assistant Developer & Programmer
- Assisted in conceptualizing the algorithms of the program
- Assisted in assessing the performance of the trial version
- Assisted in debugging the program

The development of the program was conducted systematically in order to maximize work efficiency, therefore, the final output was the result of total team effort and cooperation.

Head Developer's Remark